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Abstract:
Economic reforms in rural China have brought opportunities to diversify both within-farm activities and off-farm activities. Participation in these activities plays an important role in increasing rural households' income. This paper analyzes the factors that drive rural households and individuals in their income-source diversification choices in a Northern China township. At the household level, we distinguish three types of diversification as opposed to grain production only: within farm (non-grain production) activities, local off-farm activities, and migration. We find that land availability stimulates on-farm diversification. Local off-farm activities are mostly driven by households' assets position and working resources, while migration decisions strongly depend on the household size and composition. At the individual level, we analyze the determinants of participation in three different types of jobs as compared to agricultural work: local off-farm employment, local self-employment and migration. We find a clear gender and age bias in access to off-farm activities that are mostly undertaken by male and by young people. The households' assets position as well as village networks are found to strongly affect participation in off-farm activities.

Keywords: income-source diversification, agricultural households, off-farm employment, China.
JEL codes: J2, R2, Q1, O53

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1. Introduction

Over the past decades, there has been an outstanding trend of activity diversification in rural areas in developing countries. A rich related literature suggests that rural households adjust their activities either to exploit new opportunities created by market liberalization (Delgado & Siamwalla, 1997) or to cope with livelihood risks (Barrett *et al.* 2001a; Carter, 1997). These adjustments are found to have an important impact on income, income distribution and welfare across rural households (Block & Webb, 2001; Canagarajah *et al.* 2001; de Janvry & Sadoulet, 2001; Ellis, 1998, 2000; Hoogeveen, 2001; Reardon *et al.* 2000).

In China, the launching of economic reforms from the end of the 1970s has led to important changes in productive activities in rural areas. Pre-reform central planning and regional economic self-sufficiency policies had resulted in specialization patterns quite frequently disconnected from local comparative advantages. As a consequence, the rural economy was overwhelmingly dominated by agricultural activities, with grain crops accounting for more than 80 per cent of total sown area. Economic reforms have brought incentives and opportunities for rural households to diversify both within-farm activities and off-farm activities. First, the Household Responsibility System led to the dismantling of the People's Communes and made it progressively possible for rural households to take private decisions regarding their economic activities. At the same time, the emergence of market mechanisms through price reforms and the development of free markets encouraged profit-oriented activities. And more recently, China's joining the WTO has accelerated structural adjustments, from land-intensive grain production to more labor-intensive activities, including fruits and vegetables crops, animal husbandry and rural industrialization.

China's rural economy has been diversifying at various levels. First, the agricultural production itself has been diversified with a constant decline of farming and a steady rise of husbandry, forestry and fishery in terms of output value. Second, the importance of grain in the farming sector has dropped rapidly in favor of cash crops, whose share increased from 20 per cent of total sown area in 1978 to 35 per cent in 2003. Third, non-farm activities have thriven as illustrated by both the prosperity of rural enterprises and the huge flows of rural

migrants to urban areas. Using macroeconomic data from Chinese provinces between 1985 and 2001, Yang (2009) has shown that the production restructuring from grain crops to cash crops and the labor shift from cropping to non-agricultural activities have both significantly contributed to rural income increase and income stability in China.

The study of diversification patterns in a developing country such as China is important for several reasons apart from its expected impact on income and poverty reduction. First, in a context of missing or imperfect markets for credit, insurance, or land, diversification choices are supposed to reflect optimal strategies followed by farm households in order to balance their expected returns with the related risk exposure they face. Since all diversification strategies may not be equally lucrative, understanding both the incentives and the constraints that rural households face in their decision between alternative options can offer important insights as to what policy might effectively improve the rural poor access to higher return activities. Second, diversification choices not only reflect the allocation of household assets, but also the allocation of household labor resources across various activities. Given the large size of the rural population in China, a good understanding of how rural labor markets work and specifically, how out-migration movements and rural exodus are taking place is essential for the design of adequate rural and urban development policies. Regarding these issues, a key question is whether or not the opportunities to develop non-agricultural activities are large enough to foster the expansion of middle-size cities and towns in rural areas, or if one should continue to encourage huge flows of rural population into big cities.

The purpose of this paper is to highlight the main factors that drive rural households as well as individuals in their decision to diversify their economic activities. We use an original household survey conducted in December 2003 in a rural township (Labagoumen) located at the northern border of Beijing municipality. Traditional activity in the township used to be grain production. Economic reforms have increased opportunities for households in the township to start new activities both on farm and outside farm. The survey provides detailed information on 293 households and 627 working individuals, including information on diversification behaviors and activity choices. Although the focus is on a small area, we hope that the analysis presented below may give useful insights as to how income-source diversification is taking place in rural China.

The rapid increase of off-farm opportunities in rural China, illustrated by the development of rural enterprises and a soaring rural-urban migration, has motivated an array of empirical research on the determinants of participation in off-farm activities in China.

Most papers tend to focus on a particular choice among the different alternatives, especially on the determinants of migration (e.g. Zhao, 1999; Zhu, 2002), or to consider off-farm activities as a group without separating the different types of jobs (Zhang *et al.*, 2002). Noticeable exceptions are De Brauw *et al.* (2002) and Shi *et al.* (2007) that offer detailed analyses of the determinants of individual participation in various sub-categories of off-farm jobs. However, in this empirical literature on China, less emphasis has been given to household level choices and especially to the explanation of differences of strategies among households in terms of income-source diversification. Our paper intends to contribute to the literature by analyzing economic diversification strategies from a variety of angles. As a consequence, we not only focus on individual labor allocation between farm and off-farm activities, but we also consider household level decisions that include within-farm diversification strategies. The specific analysis of households' strategies intends to highlight the determinants of a variety of diversification behaviors, which has not been done in the existing literature on China.

Another contribution of this paper is that it relies on an original dataset that covers a geographically distinct region, with different initial economic, geographic, and ecological conditions as compared to the existing literature. Our paper shares with Shi *et al.* (2007) the characteristic that it studies a region close to an urbanized area with however rather limited opportunities for local non-farm employment (except tourism in our case). However, Shi *et al.* (2007) focus on a Southern province, where economic conditions and constraints can be expected to be quite different in terms of access to non-farm work as well as on-farm diversification opportunities from what we observe in our studied area. For instance, horticultural conditions are drastically different, with Jiangxi province mainly cultivating rice, bamboos and peanuts. Given the size of China, a good understanding on how the transition is taking place relies not only on nationally representative data, but also on more geographically focused and thorough studies that can bring additional and informative insights into diversification strategies.

Last, this paper contributes to the literature by highlighting a variety of channels for diversification decisions depending on the type of activity considered. Our estimations not only corroborate some of the results found in the existing literature but also enrich the understanding of the conditions for accessing more remunerative activities. To briefly summarize the key findings, family assets in the form of wealth, land and labor availability as well as village networks are found to play a much more prominent role than human capital in the decision to diversify at both the household and the individual level.

The questions of interest in studying income-source diversification are the following: What types of on-farm and off-farm activities do rural households engage in? What determines individual participation in the various off-farm activities? To answer these questions, we proceed in two steps. First, we analyze household level decisions to diversify among several alternatives: no diversification at all, within farm activities (towards non-grain production), local off-farm activities, and migration. Second, we analyze the determinants of individual participation in three sub-categories of off-farm activities: local off-farm employment, local self-employment and migration, where agricultural work is the reference choice.

The paper is organized as follows. Section 2 portrays diversification patterns observed in Labagoumen township over the recent years. Section 3 discusses the determinants of rural households' decision to diversify their economic activities. Section 4 provides an econometric analysis of the determinants of rural income diversification behaviors at both the household level and the individual level. Section 5 concludes.

2. Study area: diversification patterns in Labagoumen township

Our research is based upon a household survey conducted in December 2003 in Labagoumen township located in the north of Huairou county, Beijing municipality. The township government is situated 160 km away from Beijing city and 93 km from Huairou county seat (Map 1). With 302 square kilometers, it is the largest township in Huairou county and it has a population of about 7,000 inhabitants. Although it belongs to the rich municipality of Beijing, the township is a rather poor area as compared to both neighboring townships and provinces[1].The survey was carried out within a larger project designed to analyze the welfare impact of the establishment of a nature reserve in the township, under the supervision of Beijing Forestry University. Ten administrative villages were chosen so as to be fairly representative of the geographical and economic conditions of the township. In each village, 30 households in average were randomly selected. A total of 322 households were interviewed, with 293 households engaged in productive activities and 627 working individuals.

The survey provides a series of information about both family and individual members. A household includes all the persons whose main residence is the housing unit.

[1] At the time of the survey, Labagoumen township was the second poorest township in Huairou county in terms of per capita GDP, with 5,668 Yuan (approx. 2,715 PPP$) per capita per year in 1999.

Permanent residents who are temporarily away but still share their budget with other members of the household (such as students or migrants) are also included in the survey. Individual information includes personal characteristics, as well as working and migration experience over the last five years. A migrant is defined as a household member who is working outside the township and has left his/her village of origin (where he/she still holds his/her *Hukou*) for at least one month[2]. Household information includes farm and non-farm activities, income by source, durable goods and assets holding.

The rural economy in this township has been traditionally dominated by farm activities. Surrounded by high and steep mountains, it does not enjoy favorable endowments in arable land. At the township level, arable land only accounts for three per cent of total land while forestland represents 83 per cent of total land. The population pressure upon land is also severe, with an average farm size of less than 0.5 hectare per household. Until recently, the agricultural sector alone was employing most of the active population, and the area was relying on subsistence agriculture and the production of corn for seed. Agricultural households surveyed in 2003 allocated on average 51 per cent of their arable land to food crops[3], the proportion rising up to 82 per cent when corn for seed is included. Land scarcity and land fragmentation strongly constrain crop diversification: with corn being the main crop, it may appear more rational to keep the current production pattern on a network of plots belonging to different households rather than to diversify the production structure on such small plots.

In recent years however, the township has started to move to a wider range of activities, both within and out of the agricultural sector. At the household level, three types of diversification behaviors can be identified: on-farm diversification within agriculture, local off-farm activities, and rural-urban migration. Concerning on-farm diversification, the market development that characterized China over the past three decades has led to an increased commercialization of agricultural production, which is becoming more profit-oriented and

[2] There is no clear agreed-upon definition of a "migrant" in empirical studies on internal migration in China. In the official definition of the National Bureau of Statistics, a person is recorded as a migrant if she has left her registered place of residence in order to work for a certain period of time in a given year. In the 2000 census this period was 6 months, but it was one year in the 1990 census (Lin *et al*., 2004). In practice, the definition of migrants varies with the surveys used. As an example, De Brauw *et al.* (2002) and Shi *et al.* (2007) identify migrants as household members who have off-farm jobs but do not live in the household while working, without imposing any duration constraint. De Brauw and Rozelle (2008) add a duration condition of three months or more to the above definition. De Brauw and Giles (2008) consider "all registered village residents who work outside the home county to be migrants" and note that these people generally live outside the county from more than six months a year. As for our own sample, the duration of a migration sojourn (with no return) is above 3 months for 75% of the migrants and above 6 months for 60% of them.

[3] Food crops include corn, soybean, sorghum, sweet potato, rice, millet, peas and wheat.

increasingly guided by market conditions. Therefore, farmers in the township have started to convert some land from corn crop to higher value-added agricultural products, including American ginseng, liquorice and fruit trees. Husbandry practices have also been restructured to protect the region's forests and biodiversity, and as a consequence, the goat herd has been gradually reduced in favor of new types of husbandry such as battery chickens and ducks. These activities are better related to the local comparative advantages in terms of climatic and topographic conditions, and they benefit from a direct access to the market through the regular inflow of tourists in the area. Moreover, farmers who turned to these new activities have benefited from various sets of preferential policies and subsidies[4].

As for non-farm activities, two main occupational choices can be distinguished: individuals can either leave the farm and take a local non-agricultural work, or migrate to towns and cities. As shown by De Brauw *et al.* (2002), choices have shifted over time towards an increased migration, which had become the most prevalent form of off-farm activity in rural China by 2000. Although migration was not so much widespread in our research area in 2003, villagers, mostly young people, are engaged in migration, with migrants accounting for 15.6 % of the total active population. Owing to proximity to big cities such as Huairou and Beijing and to a relatively well-developed infrastructure network in the region (most villages are served by relatively well-maintained roads), a quarter of rural households had at least a member with a migration experience over the last 5 years, mostly within Beijing municipality (about 23% of migrants work within Huairou county, 30% in neighboring counties, and 35% in Beijing city). Since there are very few manufacturing enterprises in Labagoumen township, local non-farm activities are mostly related to services. One village (Sunzazhi) benefits from a particular position at the entrance of a Nature Reserve, which recently enhanced its tourist appeal. The establishment of the Nature Reserve in 1999 has led to the opening of family hotels, restaurants and the development of related tourist activities. Other non-farm activities include working for public services, local government, etc.

Our data show that in 2003, 33.7% of the surveyed households were still relying on corn production and had not yet engaged in any alternative, more lucrative activity (Table 1).

[4] Preferential policies and subsidies vary across villages. In Xiahebei village, government subsidies of 500 yuan, plus 50kg of cereal per *mu* have been given to households who started American ginseng culture. In Zhongyudian village, besides a subsidy of 400-500 yuan per *mu*, interest-free loans were also offered to households starting American ginseng cultivation. The implementation of the Sloping Land Conversion Program in the township since 2001 also brought subsidies for tree planting. On average, 26% of agricultural land had been converted by the end of 2003. Most of the land conversion (68% of converted land) concerns fruit trees, mainly chestnut trees, apricot trees and hawthorn trees (*Crataegus laevigata*).

As explained above, on-farm diversification in the context of the township refers to the cultivation of higher value-added products for sale into local markets and/or chicken farm. In 2003, 30.8% of the surveyed households were undertaking such on-farm diversification activities. As for off-farm activities, 28.3% of the surveyed households had at least one member involved in local off-farm work (at the time of the survey), and 26.5% had at least one member with a migration experience over the last 5 years[5].

Even though farmers are free to choose the crops they grow since the early 1980s, when the Household Responsibility System was introduced, their choice in terms of diversification may still largely depend on villages' strategies. As can be seen from Table 1, there are large differences across villages in the speed of activity restructuring. Since the area under study is rather small, basic differences in incentives, such as the cost of inputs, the prices received for outputs or wage rates can be expected to be fairly small too[6]. However, more meaningful variations across villages can be found in natural endowments and market access, as well as in the villages' dynamism. Indeed, important disparities in resource endowments condition the villages' ability to create income opportunities out of traditional cropping. Some fortunate villages are endowed with specific tourist sights or specific land characteristics, which attract outside investors and provide them with favorable initial conditions. Moreover, activity diversification also strongly depends on policies implemented at the local level to promote economic restructuring. Some dynamic villages did actively promote alternative activities by providing villagers with information as well as with incentives[7], while more conservative villages even forbade the process by imposing grain production to all households.

By providing additional income sources independent of the agricultural cycle, off-farm activities can increase both the level and the stability of household income (Ellis, 2000; Hoogeveen, 2001; Alderman & Paxson, 1992; Yang, 2009). As shown in Table 2, although farm income still represents more than one third of households' annual income, for those households with income from a specific source, off-farm income is by far the most remunerative. In particular, while remittances account for a rather small share in households'

[5] Since migration experience for each household member over the last five years is recorded in the survey questionnaire, we can trace migrants even if they have returned. Hence, at the household level, a migrant member is any individual who had a working experience of more than one month outside the township over the last five years.

[6] In separate administrative village surveys, village leaders were asked to provide information about the general economic, geographic and demographic conditions in the locality. Questions on input prices and wages show no strong variation across villages.

[7] In dynamic villages, the range of measures that has been adopted to encourage activity restructuring includes cash subsidies, longer land-use right, favorable terms, and training.

income for the total sample (7.6%), they represent half of the income for households with migrant members. Tourism can also be a worthwhile alternative to favor rural economic development in the township since the average annual income is as high as 8,000 yuan among households involved in tourist activities. Moreover, Table 3 shows a clear relationship between diversification patterns and per capita households' income. Although the causality can be of a bidirectional nature, it clearly reveals an over-representation of non-diversifying households in the poorest quartiles and an over-representation of households engaged in (local and non-local) off-farm activities in the richest quartiles. In sum, the remunerative nature of off-farm activities calls for a better understanding of the conditions for accessing these activities.

3. The determinants of households' diversification behaviors: theoretical linkages

Various explanations for diversification behaviors can be found in the economic literature to explain both incentives and disincentives for rural households to combine traditional crops with new crops (Norman, 1974), agricultural crops with animal husbandry or forestry activities (Kurosaki, 1995, 1997), and/or agricultural activities with off-farm activities such as migration and tourist development (Barrett *et al.*, 2001a, b; Murphy, 1999). On one hand, in a changing economic and institutional environment, agricultural households have incentives to find alternative income sources in order to secure their livelihood. But on the other hand, several factors such as risk aversion and barriers to entry can also hold them back from engaging into new activities.

A rich literature on income diversification in rural areas has identified a wide range of explanatory factors for activity restructuring out of subsistence farming at the household level (Abdulai & CroleRees, 2001; Smith *et al.*, 2001; Ellis, 1998). The motives are usually divided into two categories: "pull factors" and "push factors" (Barrett *et al.*, 2001b). Pull factors include benefits from complementarities between activities (Norman, 1974), new income opportunities created by market development (Davis & Pearce, 2001), improvement of infrastructure (Jalan & Ravallion, 1998), and diversification for asset accumulation (Hart, 1994). Push factors include *ex ante* risk management (Hoogeveen, 2001; Alderman & Paxson, 1992), *ex post* risk coping (Carter, 1997), high transaction costs (Omamo, 1998), liquidity constraint and credit market failure (Reardon *et al.*, 1994), and the seasonality of agricultural activity (Sahn, 1989). Household livelihood strategies are jointly determined by these two sets of factors. Market development encourages households to reallocate their productive

resources to higher-return activities (Xia & Simmons, 2004), while poor resource endowment, agricultural seasonality, frequent climatic hazards, and poor access to credit may all push rural households to undertake a wider range of activities in order to secure their livelihood.

Risks play a key role in the activity diversification process. Since they strongly influence rural production, income and welfare, risks are major "push" factors that encourage households to turn to a more diversified portfolio of activities (Carter, 1997; Reardon *et al.*, 1992). Both on-farm and off-farm diversification can thus be seen as efficient mechanisms for households to reduce income risks (Ellis, 1998, 2000; Hoogeveen, 2001). However, in a rapidly changing and volatile environment, uncertainty may also make agricultural households more reluctant to engage in new activities. This is particularly the case for poor households who typically have a higher absolute risk aversion (Rosenzweig & Binswanger, 1993). In a poor area, agricultural households may prefer to stick to traditional crops for which risks are known, even though expected returns associated with alternative activities are higher and a more diversified portfolio of activities would certainly reduce the expected hazard of total income. In sum, risk aversion combined with poverty traps, an ageing population and a massive migration of young people may strongly reduce incentives for poor agricultural households to allocate a higher portion of their land to non-food crops.

Risks are abundant in rural China, and given the lack of credit and insurance markets, the risk incidence is heavy for agricultural households. In the heart of a semi-dry area in northern China, Labagoumen township is exposed to climatic risks, especially droughts. Additional sources of risk in the area come from numerous market imperfections brought by institutional reforms. Given the uneven development process as well as the incompleteness of the reforms, price risks have become a prominent risk for agricultural households. Indeed, in contrast to stable State procurement prices prevailing before the reforms started, farmers now face volatile and unpredictable market prices for agricultural products, especially for "new" products whose market is often very thin and highly fragmented.

Many studies have also shown that the rural poor have less access to lucrative alternative activities than their better-off counterparts because of high barriers to entry associated with these activities (Barrett *et al.*, 2001a, b; Abdulai & CroleRees, 2001; Woldenhanna & Oskam, 2001). One of the most important barriers to entry is credit constraint: a restricted access to credit and financial savings can impede high initial investments as well as the acquisition of assets that are essential to most non-farm activities

(Barrett, 1997)[8]. In Labagoumen township, 44% of the surveyed households declared having faced a credit constraint over the last 5 years. Among those who had borrowed money over the last five years, the vast majority borrowed from parents or friends, and only a few borrowed from institutional lenders such as credit cooperatives (4%), banks (5%) and local communities (3%). Among those households who reported the reasons why they did not borrow from financial institutions, 62% reported excessive collaterals required for official loans as well as restrictive and inflexible lending conditions as the main reason, followed by refusals from financial institutions (24%), high interest rates (13%) and the lack of financial institutions (1%).

In addition to financial constraints, another important barrier to entry to better-remunerated activities lies in skills and education constraints (Smith *et al.*, 2001). In Labagoumen township, the educational attainment of farmers is low, with only 4.7 years of schooling for an average worker. Unskilled poor have no choice but to stick to activities with low education requirements and this low education level may reinforce inertia in terms of diversification behaviors. The situation may get even worse because of the sharp increase in educational costs that occurred over the past two decades in rural China. Data from our survey indicate that the average annual cost of education per child is about 2,000 yuan for children aged below 16 and jumps to more than 8,000 yuan for university-aged children. Most households cannot afford such educational costs, which leads to early dropout, even before the nine years of compulsory education. In the long run, the high cost of education may strongly limit the rural population's ability to enter into more skilled-labor intensive activities.

4. Econometric evidence

The determinants of rural income diversification can be modeled through a simple model of participation choice. As indicated above, we consider two levels of analysis: *i)* the household choice of activity portfolio, and *ii)* the individual choice of participation in off-farm activities.

[8] Even for farming activities, a restricted access to credit may reduce the incentive to invest in new activities. In Labagoumen township, most of the higher profit agricultural alternatives such as American ginseng, liquorice and tree planting require initial investment and long delays. This implies that households have to find the required initial amount plus additional income to live on before they can receive any return from their investment (a few years for ginseng, more for fruit trees, and decades for timber plantation).

Household economic diversification strategy: empirical strategy and results

At the household level, we proceed into two steps. Following the empirical strategy proposed by Micevska and Rahut (2008), we start by estimating a probit model on the probability to enter into any diversification activity. In this first step, the dependent variable equals one if the household is engaged into on-farm diversification, and/or off-farm diversification, and/or migration. To provide a thorough picture of households' diversification strategies, we then turn to more disaggregated measures of diversification activities depending on the type of activity chosen. Following the distinction highlighted above, we classify diversification activities into five groups that reflect various combinations of the available choices: on-farm diversification alone, local off-farm activities alone, migration alone, local diversification (including both on-farm and off-farm activities), and off-farm diversification (including both local off-farm and migration). A comparison of the determinants of participation into these various disaggregated categories can offer useful insights as to the incentives and constraints that households face into their choice towards the different activities.

The household diversification strategy is assumed to be a function of a vector of various household level and village level characteristics that aim at capturing the variety of theoretical channels presented in section 3[9]. In the vein of the push and pull factors portrayed above, diversification can be thought in terms of either a coping strategy or a "proactive" strategy[10]. Most household variables included in the empirical part refer to the coping capacity of households facing risks or to their risk exposure (Christiaensen & Subbarao, 2005). These variables include the age of the household head, the household average education level, the education level of the household head's father, the household size, the number of elderly, the number of male adults, and the household assets, measured by arable land per adult and by a wealth composite indicator. The wealth index is computed as a linear combination of household assets indicators through factor analysis (Sahn & Stifel, 2003). For developing countries, an asset-based approach to measure wealth is more appealing than an income-based approach for several reasons. As pointed by Sahn & Stifel (2003), households' assets are easier to measure accurately than income, and they are less likely to be suffering from reporting bias. Moreover, a wealth composite index is meant to measure an *ex ante* level

[9] A brief description of all explanatory variables used in the empirical analysis is given in Appendix 1.
[10] Various terminologies have been used in the literature to refer to these differences in perspectives. As highlighted by Lay *et al.* (2009), when diversification is meant as a coping mechanism, it is referred to as "distress-push" or "desperation-led" diversification. When it is meant as a strategy to take advantage of opportunities, it is described as "demand-pull" or "opportunity-led" diversification.

of wealth that is supposedly less subject to endogeneity problems than a simple measure of household income. A set of eight indicators has been selected to reflect both the household ownership of durable goods and the housing quality. Household durables include the ownership of a bicycle, a motorcycle, a color TV, a VCD-DVD player, a refrigerator and a washing machine. Housing quality includes indicator variables for running water and the equipment of the dwelling with a bathroom. The weights estimated from the factor analysis are given in Appendix 2. As expected, the weights are all positive since all the variables measure "access to assets" (rather than a lack of assets). The higher weights found for the ownership of durable goods such as a refrigerator, a washing machine, or a VCD-DVD player indicate that these goods are the most effective in stratifying wealth groups in our sample.

At the community level, we use various measures of village-based networks and village group dummies as proxies for market access. Village networks are introduced in order to measure the potential impact of village strategies on household activity diversification. The underlying idea is to test whether or not more diversified (along various dimensions) villages facilitate household level decisions to diversify. Moreover, as indicated in section 2, inter-villages comparisons reveal significant differences across groups of villages with respect to market accessibility. Most noteworthy variations follow the distribution of the surveyed villages along the road, with a group of four villages located along the main N111 road, a group of three villages located along the (only) secondary road and a group of three remote villages with no direct access to the main road. Empirical studies using cross-section survey data usually suffer from a clustering effect since households from the same sampling unit (villages here) generally tend to be more alike in terms of the survey than households in general because of neighborhood effects, similar local conditions, similar time of survey, etc. Correlations among units in the same cluster that occur lower the precision of estimates (United Nations, 2005). On one hand, introducing village fixed-effects can partly help controlling for characteristics at the village level, but it does not remove all between cluster variations from the models. On the other hand, to account for cluster at the household level is a tricky issue since the usual Huber-White estimator performs poorly with small number of clusters. Hence, in our probit estimates at the household level, we cannot explicitly control for a cluster effect because of the small number of clusters. However, we hope that introducing village-based networks variables and village group dummies can help improving the precision of our estimates.

Table 4 reports the marginal effects of probit estimates for the household income-source diversification strategies. At the aggregated level, the estimates given in column (1)

indicate that households are more likely to engage in any diversification if they have a larger male labor force and if they belong to villages with a higher level of diversification. These aggregate estimations suggest that family composition and village network effects are influential in terms of household diversification strategies.

Columns (2) to (4) show estimates for specific activity choices: on-farm diversification, local off-farm activity and migration. A comparison of the three estimations reveals interesting differences as well as similarities. First, the households' decision to turn to the cultivation of higher value agricultural products appears to be mostly constrained by land scarcity. Indeed, land endowment is found to play a prominent role in the decision to engage into on-farm diversification only: more arable land per adult increases the likelihood to participate into on-farm diversification. Second, local off-farm decision is found to be driven by households' asset position and working resources rather than by human capital. In particular, a higher wealth index is associated with a higher participation into local off-farm activities. Third, the migration strategy is mostly and strongly influenced by the household size and composition. Indeed, both a larger household size and a larger male labor force increase the probability to have a household member with a migration experience. These results can be explained by increasing returns to scale in household chores for households with a larger size and more labor availability that makes it easier for them to let some members engage in off-farm activities. Dercon and Krishnan (1996) on Ethiopa and Tanzania and Micevska and Rahut (2008) on India find similar results. In contrast, the presence of old members strongly reduces the likelihood of households to participate in migration, indicating that a higher dependency ratio of the household reduces the labor availability for migration. In sum, we find a stronger impact of the household composition on migration choice as compared to local off-farm, which is consistent with Shi *et al.* (2007) finding for southern China.

Results in columns (2) to (4) also highlight the importance of network effects in the households' decision to diversify. Indeed, our estimations show that a stronger engagement into diversification at the village level (measured by the number of diversifying households) increases the likelihood of households to participate in any diversification activity. This is a sign that village networks probably facilitate the adoption of new activities. In contrast, the access to markets, as proxied by village-group dummies is not found to significantly influence diversification decisions, except for migration. Households that belong to villages located along the main road or to remote villages are less likely to engage into migration, as compared to households living in villages located along the secondary road. This result may

indicate that for those households living in villages with an easier access to the market (along the main road), migration may not be the most attractive option since there may be other, local, opportunities to diversify. On the other hand, migration may not be an attractive option for households living in remote villages either, but probably for opposite reasons.

Human capital measured by the average education level of household members, the age of the household head or the household head father's education are not found to have any significant role on diversification decisions. The only, indirect, impact of education is to be found in the education level of the household head's father, which increases the likelihood of the household to undertake on-farm diversification activities.

The last two columns of Table 4 show probit estimation results for a reclassification of activities into local diversification activities (either on-farm or off-farm) or off-farm activities (either locally or through migration). Not surprisingly, these results are consistent with the coefficient estimates from columns (2) to (4), and summarize the major drivers in households' diversification behaviors. First, both human capital and family background are not found to be important. Second, local diversification appears to be mainly driven by family assets, in terms of land endowment and wealth as well as by village network effects. Third, both the family composition and wealth are associated with higher involvement into off-farm activities.

Individual participation in off-farm activities: empirical strategy and results

At the individual level, the different options available to working individuals are the following: agricultural work[11] (the reference category), local off-farm employment, local self-employment and migration to an urban area. Since the individual single decision is made among more than two alternatives without any obvious ordering, we use a multinomial logit model to analyze the determinants of the individual participation decision. The multinomial logit model being based on the strong assumption of independence of irrelevant alternatives (IIA), the IIA hypothesis is tested using the Hausman-McFadden test based on comparing the parameters obtained with the multinomial logit with the parameters obtained by excluding the alternatives one by one. The IIA hypothesis cannot be rejected at conventional levels, which allows us to use a multinomial logit model.

The set of explanatory variables includes human and social capital variables, household composition variables, household assets variables, and community characteristics.

[11] There is no agricultural wage employment in our sample. This implies that off-farm activities refer to non-farm sectors only.

Moreover, following de Janvry and Sadoulet (2001), we assume that individual decisions are not independent across members of a given household and run estimations allowing for intra-household correlations through a cluster effect. The individual decision to participate in non-farm activities versus family farming work (reference choice) is analyzed in Table 5. The reported coefficients are the exponential values that can be easily interpreted in terms of "relative risk ratios": for each variable *z*, the relative risk ratio tells us how the probability of choosing *j* relative to the baseline alternative changes if *z* increases by one unit.

Individual characteristics influence participation decisions. As De Brauw *et al.* (2002) and Shi *et al.* (2007), we find a clear gender bias in participation into off-farm activities. Men are much more likely to engage in any occupation (local wage employment, local self-employment and migration) rather than in farm labor than are women. The corresponding relative risk ratios are respectively 3.40, 4.46 and 3.67. This result stresses the clear division of labor between male and female in rural China, with women taking care of the household work and being mostly involved in farm activities. Likewise, being the child of the household head significantly increases the likelihood of out-migration, which suggests another line of division of labor within the household between farming "left behind" parents and migrating children. This is confirmed by the fact that young adults are also found to be more engaged in all types of non-farm activities than older individuals.

Education has a contrasting role on decisions to participate in off-farm activities. On one hand, a higher education level increases the individual likelihood (by 19%) to engage in a local wage work, which confirms de Brauw *et al.* (2002) findings on a sample of 6 provinces. On the other hand, education has no impact on the migration decision. Compared to empirical evidence in other developing countries, this result may appear somehow surprising. As noted by Miceska and Rahut (2008), "empirical evidence overwhelmingly finds positive effects of education on participation in non-farm activities". In our case, the fact that education does not significantly affect participation in migration can be related to the nature of jobs offered to rural migrants in Chinese cities. A well-documented feature of the urban labor market in China is that it is highly segmented between urban residents and rural migrants (Démurger *et al.*, 2009; Knight & Song, 2005). Jobs taken by rural migrants in urban areas are mostly low-skilled jobs, with no specific requirement in terms of education. Although education has been found to be an increasing determinant of individual participation in migration over the 1990s (e.g. Zhang *et al.*, 2002; De Brauw *et al.*, 2002; Shi *et al.*, 2007), the restricted access to better-paid jobs in urban areas may still hinder the importance of education for migration decision. On the other hand, the level of education in rural China is not null, which implies

that primary school education is largely sufficient to take urban low-skilled jobs with no incentives for individuals to get a higher education level. De Brauw and Giles (2008) have highlighted the trade-off between education and migration opportunity. With already high educational costs for rural households, higher expected wages in urban areas increase the opportunity cost of education in the short run as compared to the long-run expected returns to investment in education.

Household asset position is found to strongly affect individual participation in off-farm activities while household composition does not have much impact on individual decision. The only exception is the number of elderly that negatively influences the decision to migrate and reduces the probability to migrate by about 50%. In contrast, household wealth strongly increases the likelihood to engage in local off-farm activities, with a stronger effect for self-employment that requires initial investment. Finally, more arable land per adult does not significantly influence individual participation, except (but at only 15% level of significance) the decision to migrate: more land appears to retain more people in agriculture and thus reduces labor availability for migration.

Last, the community level variables indicate that village networks, measured by the number of individuals in the village engaged either in local off-farm work or in migration facilitate the participation in local off-farm work (both wage work and self-employment) but do not play a role in the decision to migrate.

5. Conclusion

The purpose of this paper was to highlight the main factors driving rural households and individuals in their decision to diversify economic activities. In developing countries, income-source diversification is a key livelihood strategy for rural households (Ellis, 1998) and as such, a good understanding of the determinants of access to off-farm sources of income across households is essential for the design of rural development policies.

In spite of the fact that one third of the households in the studied township have not engaged yet in any form of economic diversification, both non-grain cropping and off-farm activities contribute to an increased average total household income in the area. As in many parts of western China, villages in this mountainous region are characterized by land scarcity and by the absence of any strong comparative advantage in agricultural activities. Among off-farm activities, tourist development and migration are by far the most remunerative activities. Increasing rural income and reducing rural poverty thus strongly relies upon the development

of off-farm activities, including the development of a local rural industry, tourist industry as well as migration.

Conditions for success are based on the ability to increase access to off-farm activities for all rural households, particularly for households with little human, land and monetary assets. Our econometric analysis of both households' strategies and individual choices shows that key determinants of success are to be found in improved personal asset positions as well as in well-functioning labor markets in both rural and urban areas. On the assets side, we found that a better endowment in arable land par adult facilitates on-farm diversification. Most importantly, we also found that in wealthier households, the likelihood to participate in any off-farm activity at both the household and the individual level is deeply increased as compared to poorer households. Our findings support the idea that entering into more remunerative off-farm activities necessitates personal financial accumulation (especially for self-employment). This result is in line with the comprehensive study on self-employment in rural China provided by Mohaparta *et al.* (2007), in which they give support to the hypothesis that greater personal wealth eases self-employment decision by relaxing financial constraints. Developing adequate local credit institutions to serve small-scale rural investments thus appears essential to release financial constraints that most rural households face. One should note however that relaxing financial constraints may increase farmers' income without reducing income inequality. Indeed, since households' wealth may also depend on farmers' human capital or other unidentified factors, increasing the availability of credit to all farmers may or may not allow the poorest farmers to better position themselves.

Regarding education, De Brauw & Rozelle (2008) have shown that China is lagging far behind of its Asian neighbors in terms of both investment in rural education and educational attainment. Hence, although the average level of education attainment has increased over time in rural China, it remains quite low (only 6.13 years according to De Brauw & Rozelle, 2008) in view of the nine-year compulsory education goal. Our results confirm this very low level of education and show that better educated people are able to take more remunerative local wage-earning jobs. Together with the need for higher investment in rural education, our results also suggest that on the supply side, efforts are needed in urban areas to give better access to skilled jobs to rural migrants. If migrants were to be given an equal access to urban skilled jobs as compared to urban residents, higher expected returns to education would probably pull more educated people out of rural jobs.

References

Abdulai, A., & CroleRees, A. (2001). Determinants of Income Diversification amongst Rural Households in Southern Mali. Food Policy, 26, 437-452.

Alderman, H., & Paxson, C.H. (1992). Do the Poor Insure? A Synthesis of the Literature on Risk and Consumption in Developing Countries. Discussion Paper 164, Research Program in Development Studies Centre of International Studies Woodrow Wilson School, Princeton University, Princeton, NJ.

Barrett, C.B. (1997). Food Marketing Liberalization and Trader Entry: Evidence from Madagascar. World Development, 25(5), 763-777.

Barrett, C., Bezuneh, M. & Abdillahi, A. (2001a). Income diversification, poverty traps and policy shocks in Cote d'Ivoire and Kenya. Food Policy, 26 (4), 367–384.

Barrett, C., Reardon, T. & Webb, P. (2001b). Nonfarm income diversification and household livelihood strategies in rural Africa: Concepts, issues, and policy implications. Food Policy, 26(4), 315–331.

Block, S., & Webb, P. (2001). The dynamics of livelihood diversification in post-famine Ethiopia. Food Policy, 26 (4), 333–350.

Canagarajah, S., Newman, C., & Bhattamishra, R. (2001). Non-farm income, gender, and inequality: Evidence from rural Ghana and Uganda. Food Policy, 26(4), 405-420.

Carter, M.R. (1997). Environment, Technology, and the Social Articulation of Risk in West African Agriculture. Economic Development and Cultural Change, 45(3), 557-591.

Christiaensen, L., & Subbarao, K. (2005). Toward an Understanding of Household Vulnerability in Rural Kenya, Journal of African Economies, 14(4), 520-558.

Davis, J., & Pearce, D. (2001). The rural nonfarm economy in Central and Eastern Europe. In: The Challenge of Rural Development in the EU Accession Process. Lerman, Z and Csaki, C. (eds.). Washington DC: World Bank.

De Brauw, A., & Giles, J. (2008). Migrant Opportunity and the Educational Attainment of Youth in Rural China. Policy Research Working Paper 4526, Washington DC, The World Bank.

De Brauw, A., Huang, J., Rozelle, S., Zhang, L., & Zhang, Y. (2002). The evolution of China's rural labor market during the reforms. Journal of Comparative Economics, 30, 353–529.

De Brauw, A., & Rozelle, S. (2008). Reconciling the Returns to Education in Off-Farm Wage Employment in Rural China. Review of Development Economics, 12(1), 57–71.

de Janvry, A., & Sadoulet, E. (2001). Income Strategies among Rural Households in Mexico: The Role of Off-farm Activities. Word Development, 29(3), 467-480.

Delgado, C.L., & Siamwalla, A. (1997). Rural Economy and Farm Income Diversification in Developing Countries. MSSD Discussion Paper No. 20.

Démurger, S., Gurgand, M., Li, S., & Yue, X. (2009). Migrants as second-class workers in urban China? A decomposition analysis. Journal of Comparative Economics, 37(4), 610-628.

Dercon, S., & Krishnan, P. (1996). Income Portfolios in Rural Ethiopia and Tanzania: Choices and Constraints. Journal of Development Studies 32(6), 850–75.

Ellis, F. (1998). Survey article: Household strategies and rural livelihood diversification in developing countries. Journal of Agricultural Economics, 51(2), 289–301.

Ellis, F. (2000). Rural Livelihoods and Diversity in Developing Countries. Oxford: Oxford University Press.

Hart, G. (1994). The Dynamics of Diversification in an Asian Rice Region. In B. Koppel *et al.* (eds.), Development or Deterioration?: Work in Rural Asia, Boulder, CO: Lynne Reinner.

Hoogeveen, J.G.M. (2001). Income Risk, Consumption Security and the Poor. Oxford Development Studies, 30(1), 105-121.

Jalan, J., & Ravallion, M. (1998). Geographic poverty traps?. Institute for Economic Development, Discussion Paper 86. Boston: Institute for Economic Development, Boston University.

Knight, J., & Song, L. (2005). Towards a Labour Market in China, Oxford University Press.

Kurosaki, T. (1995). Risk and Insurance in a Household Economy: Role of Livestock in Mixed Farming. The Developing Economies, XXXIII-4, 464-485.

Kurosaki, T. (1997). Production Risk and Advantages of Mixed Farming in the Pakistan Punjab. The Developing Economies, XXXV-1, 28-47.

Lay, J., Narloch, U. & Mahmoud, T. O. (2009). Shocks, Structural Change, and the Patterns of Income Diversification in Burkina Faso. African Development Review, 21(1), 36-58.

Lin, J. Y., Wang, G. & Zhao, Y. (2004). Regional Inequality and Labor Transfers in China. Economic Development and Cultural Change, 52(3), 587-603.

Micevska, M., & Rahut, D.B. (2008). Rural Nonfarm Employment and Incomes in the Himalayas. Economic Development and Cultural Change, 57(1), 163-193.

Mohapatra, S., Rozelle, S. & Goodhue, R. (2007). The rise of self-employment in rural China: development or distress? World Development, 35(1), 163-181.

Murphy, R. (1999). Return Migrant Entrepreneurs and Economic Diversification in Two Countries in South Jiangxi, China. Journal of International Development, 11, 661-672.

Norman, D.W. (1974). Rationalising Mixed Cropping under Indigenous Conditions: The Example of Northern Nigeria. The Journal of Development Studies, 11(1), 3-21.

Omamo, S. (1998). Transport Costs and Smallholder Cropping Choices: An Application to Siaya District, Kenya. American Journal of Agricultural Economics, 80(1), 116-123.

Reardon, T., Crawford, E., & Kelly, V. (1994). Links between nonfarm income and farm investment in African households: Adding the capital market perspective. American Journal of Agricultural Economics, 76(5), 1172–1176.

Reardon, T., Delgado C., & Matlon, P. (1992). Determinants and Effects of Income Diversification Amongst Farm Households in Burkina Faso. The Journal of Development Studies, 28(2), 264-296.

Reardon, T., Taylor, J., Stamoulis, K., Lanjouw, P., & Balisacan, A. (2000). Effects of nonfarm employment on rural income inequality in developing countries: An investment perspective. Journal of Agricultural Economics, 51(2).

Rosenzweig, M., & Binswanger, H.P. (1993). Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments. Economic Journal, 103, 56-78.

Sahn, D.E. (1989). Seasonal Variability in Third World Agriculture: The Consequences for Food Security. Baltimore, MD: John Hopkins Press.

Sahn, D.E., & Stifel, D. (2003). Exploring alternative measures of welfare in the absence of expenditure data. Review of Income and Wealth, 49(4), 463-489.

Shi X., Heerink, N., & Qu, F. (2007). Choices between different off-farm employment sub-categories: An empirical analysis for Jiangxi Province, China. China Economic Review, 18(4), 438-455.

Smith, D. R., Gordon, A., Meadows, K., & Zwick, K. (2001). Livelihood diversification in Uganda: Patterns and determinants of change across two rural districts. Food Policy, 26(4), 421–435.

United Nations (2005). Household Sample Surveys in Developing and Transition Countries. Department of Economic and Social Affairs, Statistics Division, Studies in Methods Series F No. 96.

Xia, Q., & Simmons C. (2004). Diversify and Prosper: Peasant Households Participating in Emerging Markets in Northeast Rural China. China Economic Review, 15(4), 375-397.

Woldenhanna, T., & Oskam, A. (2001). Income Diversification and Entry Barriers: Evidence from the Tigray Region of Northern Ethiopia. Food Policy, 26(4), pp.351-365.

Yang, W. (2009). Economic Structural Changes and Rural Income: Evidence from Chinese Provinces during the Reform Period. China Economic Review, 20(4), 742-753.

Zhang, L., Huang J., & Rozelle, S. (2002). Employment, emerging labor markets, and the role of education in rural China. China Economic Review, 13, 313-328.

Zhao, Y. (1999). Leaving the Countryside: Rural-To-Urban Migration Decisions in China. The American Economic Review, 89(2), 281-286.

Zhu, N. (2002). Impacts of income gap on migration decision in China. China Economic Review, 13(2/3), 213-230.

Table 1 – Households' diversification strategies across villages

	No diversification	On-farm diversification	Local off-farm	Migration
Total	***33.7%***	***30.8%***	***28.3%***	***26.5%***
Dadianzi	39.3%	14.3%	25%	32.1%
Dongcha	42.3%	42.3%	11.5%	19.2%
Huying	39.3%	32.1%	25%	25%
Labagoumen	34.6%	26.9%	34.6%	23.1%
Maoshan	52%	16%	12%	24%
Miaoying	10.7%	78.6%	32.1%	25%
Sidaoxue	44.4%	25.9%	14.8%	22.2%
Sunzhazi	11.1%	16.7%	69.4%	30.6%
Xiahebei	26.9%	57.7%	19.2%	26.9%
Zhongyudian	46.1%	0%	23.1%	34.6%

Source: Household survey conducted by the authors in 2003.
Notes: The three types of economic diversification are defined as follows: *i*) "migration" comprises all households for which at least one member has had a migration experience over the last five years; *ii*) "local off-farm activities" includes households for which at least one member is working off-farm in the local area; *iii*) "on-farm diversification" includes households engaged in higher value agricultural products cultivation or chicken farm. Since some households may engage into more than one diversification activity, the total of the percentages given here does not sum up to 100%.

Table 2 – Diversification and household income by source, 2003

	Mean	Share in total income	% of households with income from the source	Mean among households with income from that source
Total income in yuan	6,015			
Per capita income	1,935			
Farm income	1,645	36.7%	58%	2,818
From grain crop	917	25.5%	46%	2,006
Off-farm income	3,434	44.3%	52%	6,663
From tourist activity	464	3.8%	6%	8,000
Remittances	718	7.6%	12%	5,847
Other income	936	19%	27%	3,429

Source: Household survey conducted by the authors in 2003.

Table 3 – Household diversification behavior across income per capita quartile, 2003

	Total	First (poorest)	Second	Third	Fourth (richest)
No diversification	**33.7%**	47.1%	46.3%	23.7%	17.9%
On-farm diversification	**30.8%**	38.2%	29.3%	25%	28.3%
Local off-farm	**28.3%**	4.4%	26.8%	43.4%	41.8%
Migration	**26.5%**	16.2%	15.9%	36.8%	34.3%

Source: Household survey conducted by the authors in 2003.
Notes: see Table 1.

Table 4 – Probit estimates of households' diversification choice

Determinants of P(diversification)	*Mean value*	*"Aggregate" diversification*	*On-farm*	*Local off-farm*	*Migration*	*Local divers.*	*Off-farm divers.*
		Marginal effect (Z-stat)					
Age of household head	53	.002 0.48	.0001 0.02	-.005 -1.68*	-.0002 -0.09	.0004 0.12	-.004 -1.11
Average education	4.55	.011 0.84	.008 0.64	.010 0.88	-.004 -0.36	.018 1.22	.007 0.49
Household head father's education	2.25	.010 1.03	.014 1.53	-.007 -0.68	.0009 -0.11	.005 0.51	.003 0.29
Household size	3.12	.056 1.43	.004 0.11	-.031 -0.85	.122*** 4.07	.009 0.22	.062 1.38
# Male adults	1.41	.155** 2.38	.023 0.38	.104* 1.82	.199*** 3.78	.043 0.64	.273*** 3.48
# Elderly	0.44	-.140** -2.46	.044 0.81	-.035 -0.68	-.245*** -3.62	-.012 -0.21	-.234*** -2.93
Arable land/adult	2.35	.022 1.11	.068*** 3.38	.006 0.31	-.017 -0.97	.060*** 2.74	-.030 -1.21
Wealth		.059 1.36	-.038 -0.88	.154*** 4.09	-.038 -1.13	.079* 1.73	.137*** 2.80
Village diversification	19.41	.008* 1.68	-.001 -0.25	.022* 1.69	.021*** 2.72	.014*** 2.77	.008 1.39
Village on-farm diversification network	8.5		.033*** 4.80				
Village off-farm diversification network	11.87			-.006 -0.74			
Village migration network	9.8				-.075*** -4.63		
Villages on the main road		-.049 -0.58	.031 0.38	.021 0.26	-.163*** -2.53	-.011 -0.12	-.050 -0.50
Remote villages		.042 0.52	.038 0.41	-.058 -0.70	-.161*** -2.99	.160** 1.92	-.107 -1.10
# of observations		276	276	276	276	276	276
Predicted Prob (at X bar)		70%	28%	25%	17%	52%	49%
Observed frequency		66%	31%	28%	26%	41%	49%
Pseudo R^2		0.15	0.18	0.21	0.32	0.10	0.27
Log-likelihood		-150.61	-139.17	-129.17	-109.01	-171.80	-140.04

Source: Household survey conducted by the authors in 2003.
Notes: *: Significant at 10%. **: significant at 5%. ***: significant at 1%. Robust standard errors.
Dependent variables: "aggregate diversification"=1 if the household is involved in diversification (of any type) / "on-farm"=1 if the household is involved in on-farm diversification / "local off-farm"=1 if the household is involved in local off-farm diversification / 'migration"=1 if the household is involved in migration / "local divers."=1 if the household is involved in on-farm diversification or in local off-farm diversification / "off-farm divers."=1 if the household is involved in local off-farm diversification or in migration.

Table 5 – Determinants of off-farm individual participation

	Mean value	Local wage employment		Local self-employment		Migration	
		Relative risk ratio	P-value	Relative risk ratio	P-value	Relative risk ratio	P-value
Individual characteristics							
Age	48.1	0.952***	-2.48	0.936***	-3.08	0.901***	-4.06
Education	5.1	1.192***	3.30	1.063	1.13	0.995	-0.11
Gender (male=1)	55%	3.399***	3.92	4.460***	4.16	3.689***	4.77
Child of the household head	14%	0.980	-0.03	0.155	-1.54	3.397***	2.60
Household characteristics							
Household size	3.3	0.777	-1.12	0.932	-0.32	1.122	0.52
# Children less than 7		1.201	0.32	0.402	-1.07	0.614	-0.95
# Elderly	0.5	1.353	0.95	0.896	-0.31	0.567*	-1.59
Arable land/adult	2.3	0.959	-0.28	0.892	-0.92	0.801	-1.50
Wealth		2.230***	3.26	2.878***	4.39	1.252	0.95
Community characteristics							
Village off-farm network		1.029**	2.09	1.045***	3.06	1.016	1.20
Villages on the main road		1.221	0.36	1.177	0.23	0.696	-0.77
Remote villages		2.094	1.30	0.705	-0.46	1.300	0.53
Number of observations in the category	579	52		46		90	
Pseudo R^2	0.31						

Source: Household survey conducted by the authors in 2003.
Notes: The reference choice is "agricultural work on family farm" (391 observations).
The relative risk ratio for a one-unit change in a variable is the exponential value of the corresponding coefficient (exp(b) rather than b). Standard errors and confidence intervals are similarly transformed. Individual decisions are not assumed to be independent across members of a given household. Standard errors are adjusted for clustering by households (273 households).
*: Significant at 10%. **: significant at 5%. ***: significant at 1%.

Map 1 - Beijing Municipality and Labagoumen Township

Appendix 1 – Explanatory variables definition

Individual level variables	
Age	Age
Education	Number of years of schooling
Gender	Dummy variable: male=1
Child of the household head	Dummy variable: child of the household head=1
Household level variables	
Age of the household head	Age of the household head
Average education	Average number of years of schooling of household members not at school in 2003
Household head father's education	Number of years of schooling of the father of the household head
Household size	Number of permanent members in the household
# Male adults	Number of male adults in the household
# Children less than 7	Number of children aged less than 7 in household
# Elderly	Number of household members over 65
Arable land/adult	Arable land are (in *mu*) per adult member of the household
Wealth	Wealth composite index computed as a linear combination of household assets indicators through factor analysis.
Community level variables	
Village diversification	Number of households (dropping the observed household) engaged in any diversification activity in the village
Village on-farm diversification network	Number of households (dropping the observed household) engaged in on-farm diversification activity in the village
Village off-farm diversification network	Number of households (dropping the observed household) engaged in off-farm diversification activity in the village
Village migration network	Number of households (dropping the observed household) engaged in migration in the village
Village off-farm network	Number of individuals (dropping the observed individual) engaged in local off-farm activity or in migration in the village
Villages on main road	Village-group dummy variable: (Dadianzi, Labagoumen, Maoshan, Sidaoxue) =1
Remote villages	Village-group dummy variable: (Dongcha, Huying, Miaoying) =1

Appendix 2 – Wealth composite index: computation method and results

The construction of a wealth composite index A as a linear combination of individual assets a_i requires the computation of weights α_i, so that $A = \sum_i \alpha_i . a_i$. When no price or quality indicators are readily available for these assets, an appealing approach to estimate the weights is to perform statistical analysis for data reduction, either through principal component analysis or through factor analysis. A detailed discussion of the pros and cons of each approach is beyond the scope of this appendix, but as shown by Sahn & Stifel (2003), both methods yield similar results as to the households ranking when computing household wealth indexes.

In this paper, we follow Sahn & Stifel (2003) and perform a factor analysis to determine the weights (or scoring coefficients) used in the computation of A. The basic idea of factor analysis is to find unknown common factors that linearly reconstruct the various individual assets a. As in Sahn & Stifel (2003), we assume that "the *one* common factor that explains the variance in the ownership of the set of assets is a measure of 'welfare' (p. 467)". The wealth composite index is then obtained as a weighted sum of the standardized assets with the respective weights given by the scoring coefficients for the first factor. The Table below shows the estimated weights used for the construction of our wealth index.

Factor analysis - Scoring coefficients for individual assets

Variable	*Scoring coefficient (weight)*	*Observed frequency*
Bicycle	0.02426	64.85%
Motorcycle	0.11725	16.72%
Color TV	0.17268	77.47%
VCD-DVD player	0.23153	21.5%
Refrigerator	0.29577	25.26%
Washing machine	0.27503	35.49%
Running water	0.04247	85.32%
Bathroom in the dwelling	0.17353	11.6%

Source: Household survey conducted by the authors in 2003.